Solar Powered Lawn Mower

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Abstract

Each weekend, about 54 million Americans mow their lawns, using 800 million gallons of gas per year and producing tons of air pollutants. Garden equipment engines, which have had unregulated emissions until the late 1990's, emit high levels of carbon monoxide, volatile organic compounds and nitrogen oxides, producing up to 5% of the USA's air pollution and a good deal more in metropolitan areas. According to the U.S. Environmental Protection Agency (EPA), a new gas-powered lawn mower produces volatile organic compounds and nitrogen oxides emissions air pollution in in in one hour of operation as 11 new cars each being driven for one hour. The solar powered lawn mower is aa fully autonomous robot with capabilities to cut the grass independently. The robot uses 12v batteries to power itself and all the sensors. The motors to help move the robot and the grass cutter are controlled by and Arduino microcontroller that controls the movement based on incoming data from the ultrasonic sensors used for object detection and the humidity sensors to check for the non-grassy areas. The 12-volt battery is continuous charged by a solar panel housed on the top of the robot that also acts as a secure panel for weatherproofing the sensors underneath. The robot is compact and very cheap in comparison to any product in the market. The most common solar powered robot called the lanmow costs an upwards of $2000 and needs a technical installation. The solution presented here has a simple self-serve placement right out of the box. There is no technical installation required, no setup required and it is substantially cheaper than any current market solution while being environmentally friendly.

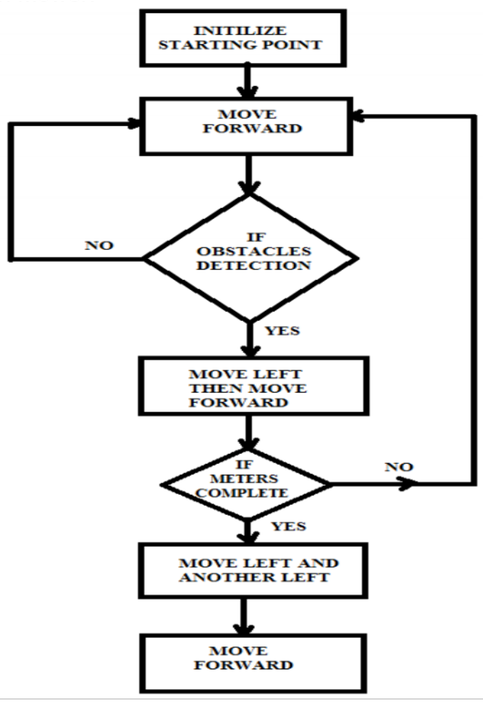
Keywords: Solar Panel, Robot, Arduino, Lawn Mower

Introduction

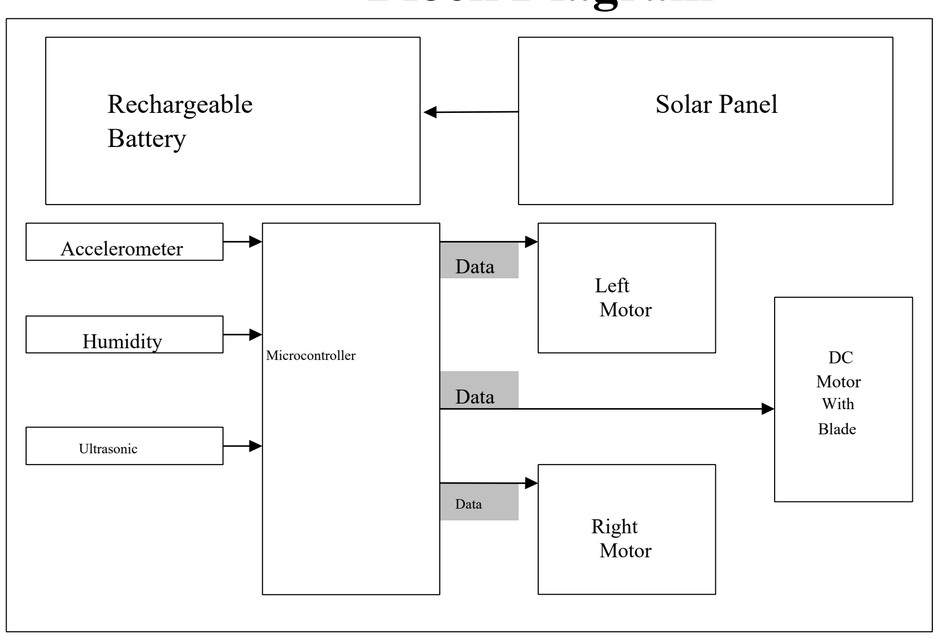
Nowadays pollution is a major issue for whole world. Pollution is manmade and can be seen in own homes. In case Gas powered lawn mowers due to the emission of gases it is responsible for pollution. Also the cost of fuel is increasing hence it is not efficient. So the Solar powered lawn cutters are introduced. Solar powered lawn mower can be described as the application of solar energy to power an electric motor which in turn rotates a blade which does the mowing of a lawn. Solar energy is the renewable energy.
Grass cutter or lawn mowing with a standard motor powered lawn mower is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, or disabled people. Motor powered push lawn mowers and riding lawn mowers create noise pollution due to the loud engine, and local air pollution due to the combustion in the engine. Also, a motor powered engine requires periodic maintenance such as changing the engine oil. Even though electric lawn mowers are environmentally friendly, they too can be an inconvenience. Along with motor powered lawn mowers, electric lawn mowers are also hazardous and cannot be easily used by all. Also, if the electric lawn mower is corded, mowing could prove to be problematic and dangerous. The self-propelling electric remote control lawn mower is a lawn mower that has remote control capability. This prototype is robotic user friendly, cost efficient, safe to use, effiefficient to use, and environmentally friendly. It can save significantly on labor costs.

Working Principle/Calculation

An electric Lawn mower There are so many complication with Electric Lawn mower Like Electricity, Wiring, Efficiency, Ecofriendly etc. And design is so complicated so behalf of Electric lawn mower we have made Solar power grass cutter which is efficient ,less noisy,No need of any external wiring. The basic idea is that we have made grass cutter with electric motor that runs from a 12 volt battery. This battery will be charged using solar panel of 5W. The Flow Chart Describes the basic functionality of the lawn Mower.



Block Diagram



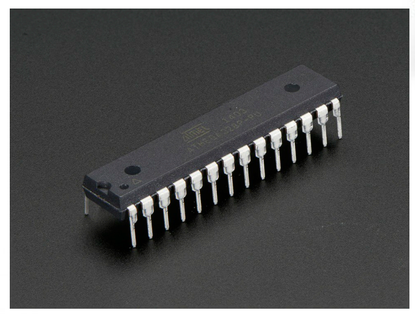
System Block Diagram

We wanted our robot not to start operating if it was being held in the air by the user. Knowing that the user would be randomly holding the robot we needed a sensor to detect orientation. The accelerometer was thought of being used because it can detect its orientation based on pre calibrated axis orientation. The power the system there are many options. With recharging batteries, there are various chemistries but we decided to go with the one that work best with solar charging. The nickel-metal hydride (NiMH) was found to be the best because given a low charging current, it will not over charge. Sizing the battery will depend on what we are powering, specifically the motors. Like batteries, there is a range of motors to choose from. We went with two 7.2 DC motors with integrated gear heads. The needed torque did not need to be a lot because we were going to have a small prototype. These motors have 100 oz-in torque which is plenty for our design. The block diagram of our design is shown in figure 1

Device Fabrication & Components

1. Display Cable
2. Battery
3. 12V Batteries
4. Robot Chassis
5. Ultrasonic Sensor
6. Sensor Kits(All Sensors)
7. Motors Kit
8. Wheels
9. Solar Panel
10. Arduino Microcontroller

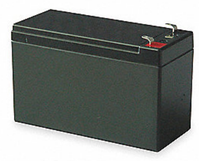
Ultrasonic Sensor



ATMEGA 32 Microcontroller

Robot Chassis

Solar Panel

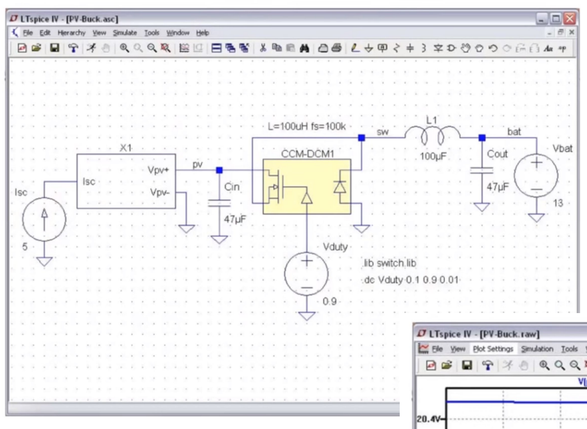


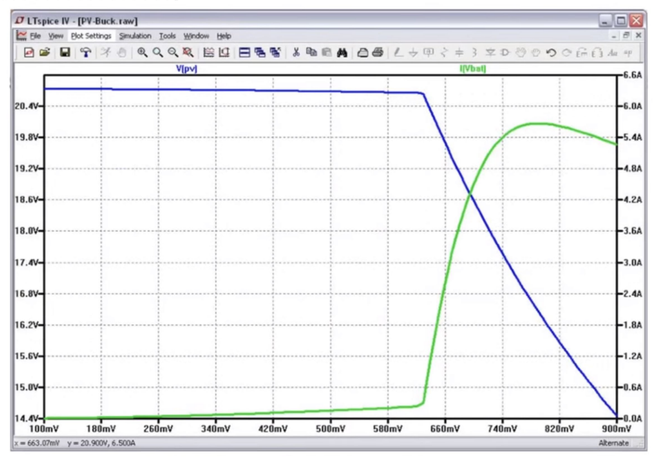
12 V Battery

DC motors and Wheels

Simulations

We Used a Buck Convertor Circuit model to run our simulation to determine best optimization. Using separate switching elements that help capture smaller frequencies and by defining switch components placed in switch network for the port 1 voltage and current of transit Q 1 Port 2 voltage and current of the Dialed rectifier we were able to simulate the results of the Voltage output and battery charging time. On the left is our complete circuit diagram generated on P-Spice simulator. Using a CCM-DCM model we used the variables Et to controlled the voltage source that controlled the voltage source on GD can be evaluated is continues conduction mode. Using the Value of inductance and value of switching frequency we decide if convertor is continuous or switching mode





Simulation results

From the Above graph it was seen that the Blue line is Output of solar panel and Green line is current Charging of Battery. On the X axis is duty cycle in millivolts from 0.1 to 0.9 V. Given that we are in continuous conduction mode the output of convertor is same as open of the circuit voltage of solar panel and as we see the duty cycle is increases solar panel voltage drops and current charging the battery increases maximum battery charged

Project Management

Abdullah Alkhater				
Research the Topic to Understand Project	5 days	Sat 9/15/18	Thu 9/20/18	
Meet with Lab Member to Discuss Questions	64 days	Sat 9/15/18	Wed 12/12/18	
Reserch on prototype of robot	7 days	Wed 10/3/18	Thu 10/11/18	
Develop software requriment specification	12 days	Fri 11/2/18	Sun 11/18/18	
Create Block Diagram	4 days	Wed 10/3/18	Mon 10/8/18	
Abdullah Almelehi				
Research the Topic to Understand	5 days	Sat 9/15/18	Thu 9/20/18	
Meet with Lab Member to Discuss Questions	64 days	Sat 9/15/18	Wed 12/12/18	
Patent search	5 days	Wed 10/3/18	Tue 10/9/18	
Develop mathmatical model	11 days	Thu 11/1/18	Thu 11/15/18	
Background reserch	5 days	Tue 10/2/18	Mon 10/8/18	
Yuosuf Alqubaisi				
Research the Topic to Understand	5 days	Sat 9/15/18	Thu 9/20/18	
Meet with Lab Member to Discuss Questions	64 days	Sat 9/15/18	Wed 12/12/18	
research on GUI design system	7 days	Thu 10/4/18	Fri 10/12/18	
Develop flow chart	4 days	Wed 10/3/18	Mon 10/8/18	

Conclusion

The lawn mower presented here is just an example how to produce, but you can personalize various components to your liking, beginning with the chassis and up to the electric-mechanical part, and find the best solution for your specific requirements. It can be helpful for understand, far from being an underwear mower that can replace a commercial product (that has quite different prices).

Refrerences

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